

# PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: JOSEPH JAMES FILLINGHAM, GILBERT NORMAN WELSBY,  
and LAWRENCE FREDERICK DURRANS

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## COMPLETE SPECIFICATION

### Improvements in or relating to methods of Attaching Studs to Metal Bars and other Metal Articles

5 We, BRITISH INSULATED CALLENDER'S CABLES LIMITED, a British Company, of Norfolk House, Norfolk Street, London, W.C.2, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to the attachment of malleable metal studs to malleable metal plates, bars and other malleable metal articles, hereinafter referred to as bars. As an example of one application of the invention may be mentioned the attachment of a series of copper or copper - rich alloy studs to an electrical copper busbar in such a manner that the studs project on one side of the busbar for the attachment of electrical contact members thereto. In the attachment of studs of this nature to busbars difficulties have arisen. These are overcome by the present invention which provides an improved method for the attachment of malleable metal studs to a bar of malleable metal which is economical both as regards costs of materials and labour and yet ensures a very secure attachment of the stud to the bar.

15 In the improved method according to the invention the stud to be attached to the bar is inserted into a hole extending through the bar from one side to the other, so that the stud projects from the bar on one or on both sides. In the former case the metal of the bar is forced into intimate contact with the stud projecting from the side of the bar by indenting the bar adjacent the stud and on the opposite side of the bar the metal of the stud is forced into intimate contact with the bar. In the latter case the metal of the bar is forced into intimate contact with the stud by indenting the bar adjacent the stud on each side of the bar. In each case the two operations are

carried out simultaneously.

Where the stud projects on one side of the bar only the indenting of the surface of the bar on that side may be effected with the aid of a tool having the form of a metal sleeve which has a through bore or is closed at one end and open at the other, the indenting surface being provided by the annular end face of the sleeve or by an annular projection on that end face. On the other side of the bar the metal of the stud may be forced into intimate contact with the bar with the aid of a tool having a projection of appropriate shape and dimensions for bringing into contact with the end of the stud. To attach the stud to the bar the stud is inserted into a hole extending through the bar from one side to the other so that the stud projects on one side of the bar with its other end lying substantially flush with the other side of the bar. The two tools can then be placed in position on opposite sides of the bar, the sleeve, which is internally dimensioned to make a fairly close fit with the projecting portion of the stud, being placed over that portion with its end face or the projection on its end face lying in proximity to that side of the bar, the second tool being placed on the other side of the bar with its projection in proximity to the adjacent end of the stud. Pressure is then exerted upon the tools in a direction to cause them to move relatively towards one another, the sleeve then indenting the surface of the bar adjacent the stud to force the metal of the bar into intimate contact with the stud and the projection on the other tool forcing the metal of the stud outwards into intimate contact with the adjacent part of the bar, thus securely attaching the stud to the bar. Where the stud is required to extend on both sides of the bar, two metal sleeves are used, one on each side of the bar to form indentations in the opposite

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surfaces of the bar and force the metal of the bar into intimate contact with the adjacent parts of the stud.

The invention will be described further with the aid of the accompanying drawings, wherein

Figure 1 is a sectional elevation,

Figure 2 is a perspective view,

Figure 3 is a sectional elevation,

Figure 4 is a fragmentary view in section drawn to an enlarged scale, and

Figure 5 is a sectional elevation.

In the following description it is assumed that a solid stud 1 having a screw thread 2 is intended to be attached to a bar 3 of rectangular cross-section and having sides 4 and 5, in such a manner that the stud, after attachment to the bar, projects on one side of the bar only, i.e. from the side 4. The bar 3 has a screw-threaded aperture 6 which extends right through the bar from one side to the other and in making the attachment, the stud 1 is screwed into the aperture 6. The stud and the bar are both made of malleable metal, for example, copper.

The attachment of the stud 1 to the bar 3 is made with the assistance of tools 7 and 8. The tool 7 has a deep recess which is screw-threaded as indicated at 9. The length of this recess is made substantially equal to the length of the stud 1. The tool 7 has an end face 10 provided with an annular projection 11. One end of the stud 1 is provided with a recess 12 to weaken the stud at that part and when attaching the stud to the bar the stud is screwed into the aperture 6 until the recessed end of the stud is flush, or substantially flush, with the side 5 of the bar, so that the stud 1 will then project from the bar 3 on the side 4. The tool 7 can then be screwed on to the stud 1 until its annular projection 11 lies in close proximity to the side 4 of the bar 3. When the tool is in this position the annular projection 11 closely surrounds the adjacent part of the stud 1. To provide for a firm contact between the annular projection 11 and the side 4 of the bar 3, the external surface of the tool 7 may be given a hexagonal shape, as indicated in Figure 2, in order that when screwing the tool on to the stud 1, the tool may be engaged by a spanner. The external surface of the tool 7 need not, of course, necessarily be of hexagonal shape but may have any other convenient shape to provide for the use of a spanner or other device when screwing the tool on to the stud.

The tool 8 may conveniently have the form of a cylinder having an end face 13 at the central part of which is provided a projection 14. When attaching the stud 1 to the bar 3 the projection 14 is caused to enter the recess 12 provided in one end of the stud 1. The projection 14 has a conical surface 15 and a flat end face 16 and the recess 12 in the end of the stud 1 is made of a corresponding shape,

but the relative dimensions of the projection 14 and of the recess 12 are such that the projection 14 can only partially enter the recess 12 until pressure is exerted upon the tool 8 to force the projection 14 further into the recess 12. The application of such pressure may result in the end face 16 being brought into contact with or in close proximity to the bottom of the recess 12.

To secure the stud 1 to the bar 3 the stud is screwed into the threaded aperture 6 until its recessed end is flush with the side 5 of the bar and the tool 7 is then screwed on to the projecting portion of the stud until the annular projection 11 on the tool 7 is brought into hard contact with the side 4 of the bar. This position is indicated in Figure 3 and in that position the tool 7, stud 1 and bar 3 are locked together. The tool 8 is then brought up to the bar to cause the projection 14 to enter partially into the recess 12 in the stud, as indicated in Figure 4. Pressure is then exerted upon the tools 7 and 8 to cause their relative movement in such a direction as to force the projection 14 further into the recess 12 in the stud. Simultaneously with this further movement of the projection 14, the annular projection 11 on the tool 7 is forced into the metal of the bar 3 on the side 4. The further entry of the projection 14 into the recess 12 has the effect of forcing the metal of the stud 1 outwards into intimate contact with the adjacent part of the bar 3 as indicated at 18 in Figure 5. The effect of forcing the annular projection 11 into the bar on the side 4 is to force the metal of the bar adjacent the stud 1 inwards into intimate contact with the latter and to form an annular recess or indentation 17 (see Figure 5) around the stud in the side 4 of the bar. The stud 1 is thus firmly secured to the bar 3 and the forcing of the metal of the stud into intimate contact with the bar and the forcing of the metal of the bar into intimate contact with the stud 1 are effected simultaneously.

The relative movement of approach to the tools 7 and 8 may be carried out in any convenient manner, for example the tool 7 may be supported and held stationary while the tool 8 is being operated upon by a hydraulic press. Alternatively one or more blows, as may be required, may be delivered to the outer end of the tool 8, the tool 7 being held stationary.

As will be understood, the method may be applied to the case where it is required that the stud should project on both sides of a bar instead of on one side only, as described above. Where such is the case a tool similar to that indicated by the reference numeral 8 would not be used but would be replaced by a tool similar to that shown at 7, so that on each side of the bar the metal of the bar adjacent the stud would be forced into intimate contact with the stud to secure the latter to the bar,

an annular recess or indentation similar to that shown at 17 being formed on each side of the bar 3. The tool 7 as described has the form of a cap nut being provided with a screw-threaded deep recess 9. The tool 7, however, could be modified by forming it as a sleeve provided with a through bore and an end face of the sleeve could be used in place of the annular projection 11 for the purpose of forcing the metal of the bar 3 into intimate contact with the stud 1. When using such a sleeve having a through bore its external surface or a part thereof could be of any convenient shape to facilitate the turning of the sleeve on the stud by means of a convenient tool. As a further alternative, it would be possible to make use of a stud in which the projecting portion on one side of the bar had a plain surface. Where the stud is intended to project on both sides of the bar then each of such projecting portions could have a plain surface. In such cases the nut or sleeve could have a recess or a through bore having a plain surface, the nut or sleeve being arranged to make a fairly close fit with the plain surface of the projecting portion of the stud.

The invention has the advantage that the two operations carried out on opposite sides of the bar can be quickly performed and a whole series of studs can be attached to a bar in a relatively short time with the aid of simple tools. The latter may be of steel, for example, and are removed after the completion of the attachment of one stud and are then available for use in the attachment of other studs to the bar.

#### WHAT WE CLAIM IS:—

1. A method of attaching a malleable metal stud to a malleable metal bar, comprising inserting the stud into a hole extending through the bar from one side to the other so that the stud projects from the bar on one or on both sides and, where the stud projects on one side of the bar only, forcing the metal of the bar into intimate contact with the stud projecting from that side by indenting the bar adjacent the stud and on the opposite side of the bar, forcing the metal of the stud into intimate contact with the bar, or where the stud projects from the bar on both sides, forcing the metal of the bar into intimate contact with the stud by indenting the bar adjacent the stud on each side of the bar, the forcing of the metal of the bar into contact with the stud on one side of the bar and the forcing of the metal of the stud into contact with the bar on the other side of the bar in the case where the stud projects from the bar on one side only, being carried out simultaneously, or in the case where the stud projects from the bar on both sides, the forcing of the metal of the bar into contact with the stud on the two sides of the bar being carried out simultaneously.

2. A method of attaching a malleable metal

stud to a malleable metal bar with the aid of two tools, one of which is a sleeve having a through bore or is closed at one end and open at the other and has an indenting surface provided by an annular end face of the sleeve or by an annular projection on that end face, the other tool having a projection of appropriate shape and dimensions for bringing into contact with an end of the stud, the method comprising inserting the stud into a hole extending through the bar from one side of the bar to the other so that the stud projects from the bar on one side only, placing the sleeve, which is internally dimensioned to make a fairly close fit with the projecting portion of the stud, over the projecting portion with its indenting surface lying in close proximity to that side of the bar and placing the second tool on the other side of the bar with its projection in proximity to the adjacent end of the stud and exerting pressure upon the tools in a direction to cause the sleeve to indent the surface of the bar adjacent the stud to force the metal of the bar into intimate contact with the stud and the projection on the other tool to force the metal of the stud outwards into intimate contact with adjacent part of the bar, the indenting of the bar and the forcing of the metal of the stud into contact with the bar being carried out simultaneously.

3. A method of attaching a malleable metal stud to a malleable metal bar with the aid of two tools, each of which is a sleeve having a through bore or is closed at one end and open at the other and has an indenting surface provided by an annular end face of the sleeve or by an annular projection on that end face, the method comprising inserting the stud into a hole extending through the bar from one side of the bar to the other, so that the stud projects on both sides of the bar, placing one of the sleeves over one of the projecting portions of the stud with its indenting surface lying in close proximity to that side of the bar, placing the other sleeve over the other projecting portion of the stud with its indenting surface lying in close proximity to that side of the bar, the two sleeves being internally dimensioned to make fairly close fits with their respective projecting portions of the stud, and exerting pressure upon the two sleeves to cause them to move relatively towards one another and to cause each sleeve to force the metal of the bar into intimate contact with the stud, the forcing of the metal of the bar into contact with the stud being carried out by the two tools simultaneously.

4. A method of attaching a malleable metal screw-threaded stud to a malleable metal bar having a tapped hole extending through it from one side to the other, comprising screwing the stud into the hole so that it projects from the bar on one side only, the opposite end of the stud lying substantially flush with the bar on the other side of the bar, screwing

a cap nut on the projecting portion of the stud to bring an annular projection on an end face of the cap nut into close proximity to the adjacent surface of the bar and bringing a second tool into proximity to the surface of the bar on the other side thereof to cause a suitably shaped and dimensioned projection on the tool to enter partially a suitably shaped and dimensioned recess in the adjacent end of the stud, and exerting pressure upon the tools in a direction to cause the projection on the cap nut to force the metal of the bar into intimate contact with the stud on one side of the bar and the projection of the second tool to force the metal of the stud outwards into intimate contact with the adjacent part of the bar on that side of the bar.

5. A method of attaching a malleable metal screw - threaded stud to a malleable metal bar having a tapped hole extending there-through, comprising screwing the stud into the hole so that it projects from the bar on both sides, screwing cap nuts on the projecting portions of the studs to cause annular projections on end faces of the cap nuts to lie in close proximity to the adjacent surfaces of the bar and exerting pressure upon the two cap nuts simultaneously, to cause the projections to force the metal of the bar into intimate contact with the stud.

H. H. DAKER,  
Agent for the Applicants,  
21, Bloomsbury Street, London, W.C.1.

#### PROVISIONAL SPECIFICATION

### Improvements in or relating to methods of Attaching Studs to Metal Bars and other Metal Articles

We, BRITISH INSULATED CALLENDER'S CABLES LIMITED, a British Company, of Norfolk House, Norfolk Street, London, W.C.2, do hereby declare this invention to be described in the following statement:—

This invention relates to the attachment of malleable metal studs to malleable metal plates, bars and other malleable metal articles, hereinafter referred to as bars. As an example of one application of the invention may be mentioned the attachment of a series of copper or copper - rich alloy studs to an electrical copper busbar in such a manner that the studs project on one side of the busbar for the attachment of electrical contact members thereto. In the attachment of studs of this nature to busbars difficulties have arisen. These are overcome by the present invention which provides an improved method for the attachment of malleable metal studs to a bar of malleable metal which is economical both as regards costs of materials and labour and yet ensures a very secure attachment of the stud to the bar.

In the improved method according to the invention the stud to be attached to the bar is inserted into a hole extending through the bar from one side to the other, so that the stud projects from the bar on one or on both sides. In the former case the metal of the bar is forced into intimate contact with the stud projecting from the side of the bar by indenting the bar adjacent the stud and on the opposite side of the bar the metal of the stud is forced into intimate contact with the bar. In the latter case the metal of the bar is forced into intimate contact with the stud by indenting the bar adjacent the stud on each side of the bar. In each case the two operations are carried out simultaneously.

Where the stud projects on one side of the bar only the indenting of the surface of the bar on that side may be effected with the aid

of a tool having the form of a metal sleeve which has a through bore or is closed at one end and open at the other, the indenting surface being provided by the annular end face of the sleeve or by an annular projection on that end face. On the other side of the bar the metal of the stud may be forced into intimate contact with the bar with the aid of a tool having a projection of appropriate shape and dimensions for bringing into contact with the end of the stud. To attach the stud to the bar the stud is inserted into a hole extending through the bar from one side to the other so that the stud projects on one side of the bar with its other end lying substantially flush with the other side of the bar. The two tools can then be placed in position on opposite sides of the bar, the sleeves, which is internally dimensioned to make a fairly close fit with the projecting portion of the stud, being placed over that portion with its end face or the the projection on its end face lying in proximity to that side of the bar, the second tool being placed on the other side of the bar with its projection in proximity to the adjacent end of the stud. Pressure is then exerted upon the tools in a direction to cause them to move relatively towards one another, the sleeve then indenting the surface of the bar adjacent the stud to force the metal of the bar into intimate contact with the stud and the projection on the other tool forcing the metal of the stud outwards into intimate contact with the adjacent part of the bar, thus securely attaching the stud to the bar. Where the stud is required to extend on both sides of the bar, two metal sleeves are used, one on each side of the bar to form indentations in the opposite surfaces of the bar and force the metal of the bar into intimate contact with the adjacent parts of the stud.

The stud may be screw - threaded either for the whole of the length of the stud or for

a part only of its length, the portion or portions projecting on one side or on each side being screw - threaded or having plain surfaces. Where the stud is screw - threaded  
 5 throughout its length and is intended to project on one side only of the bar, the sleeve forming the indenting tool may be internally screw - threaded to screw on a projecting portion of the stud. The sleeve or a part of its  
 10 length may have an external cross - section of hexagonal or other convenient non - circular form.

In the following example it is assumed that the bar and the stud are of copper and that  
 15 the stud is intended to project on one side only of the bar. A threaded hole extending right through the bar is tapped in the latter and the stud screwed into the hole such that that end of the stud lies flush with the adjacent side of the bar or for a short distance  
 20 beyond that side. A tool having the form of a cap nut with an annular projection on the end face at its open end is screwed on to the projecting portion of the stud to bring the annular projection into contact with the adjacent  
 25 side of the bar and the bottom of the recess in the cap nut into close proximity to the end of the stud. The end of the stud lying adjacent the other side of the bar has a conical  
 30 recess and into the latter is inserted a conical

projection forming part of a second tool. The projection and the recess are so dimensioned that when the surface of the tool from which the projection extends is in contact with the bar, the projection is at a short distance from  
 35 the bottom of the recess in the stud and the conical surface of the projection is in contact with or in close proximity to the conical surface of the recess. The nut can then be supported against movement and pressure exerted upon the second tool by hydraulic means or by  
 40 one or more sharp blows given to the second tool. This will cause the nut to form an annular indentation in the bar close to the stud and force the metal of the bar into intimate contact with the stud and at the same  
 45 time the metal of the stud around the recess is forced outwards into intimate contact with the adjacent part of the bar, thus attaching the stud securely to the bar. The two operations  
 50 can be quickly performed and a whole series of studs can be attached to a bar in a relatively short time and with the aid of simple tools. The latter may be of steel, for example, and are removed after the completion of the  
 55 attachment of one stud for use in the attachment of the other studs to the bar.

H. H. DAKER,  
 Agent for the Applicants,  
 21, Bloomsbury Street, London, W.C.1.

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Fig.1.

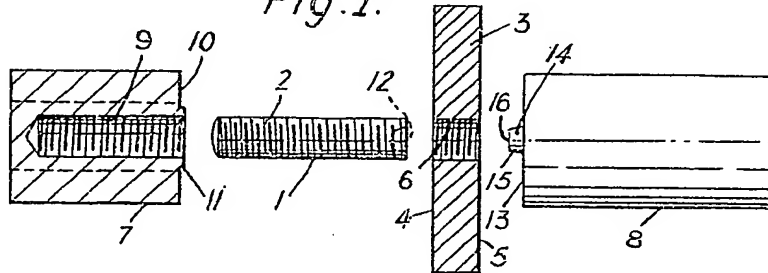


Fig.2.

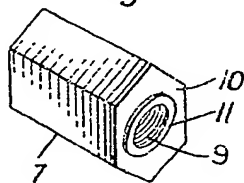


Fig.3.

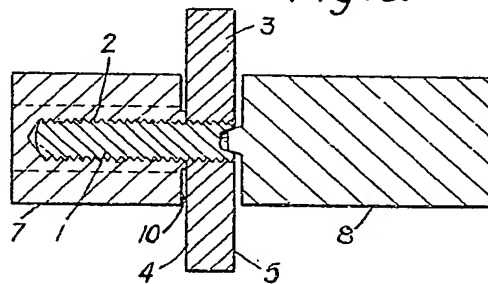


Fig.4.

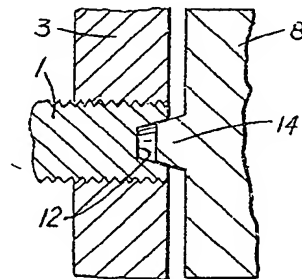


Fig.5.

